STATUS OF THE RED FOX IN OKLAHOMA AND COMPARISON OF 3 FURBEARER SURVEY TECHNIQUES

By

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STATUS OF THE RED FOX IN OKLAHOMA AND

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SURVEY TECHNIQUES

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PREFACE

This study was designed with two separate objectives: to determine the current status of the red fox in Oklahoma, and to compare 3 extensive survey methods for monitoring furbearer populations. Museum records, a mail survey to professional wildlife personnel and field observations were used to determine red fox status. Results of a farm operator mail survey and 2 variations of a scent station survey were analyzed to meet the second objective.

The 2 chapters of this thesis were prepared using the formats of 2 scientific journals. Each chapter is complete and requires no supportive information. The format of Chapter I meets the specifications of The Southwestern Naturalist. Chapter II follows the format of Wildlife Society Bulletin.

Funds for this study were provided by Pittman-Robertson Project W-129-R, Study 2, Job 1, in cooperation with the Oklahoma Department of Wildlife Conservation and the Oklahoma Cooperative Wildlife Research Unit.

I am grateful to the Oklahoma Department of Wildlife Conservation for permitting the use of their scent station survey data. I thank the Agricultural Stabilization and Conservation Service for providing access to their farm operator lists after conditions under the 1973 Privacy Act had been met.

I express appreciation to my major adviser, Dr. James H. Shaw, for conception of and procuring funds for the study, and for his advice during thesis development. Appreciation is also extended to Dr. Paul A. Vohs, Dr. John A. Bissonette, and Dr. Bryan P. Glass for serving on my committee and providing helpful comments. Dr. William D. Warde also provided helpful suggestions. I thank J. Hammond Eve for his contribution to the project's conception and funding, and for providing coordination with the Oklahoma Department of Wildlife Conservation. I thank Dan L. Peters for help in data collection and field work during the initial stage of this study.

Other contributors to whom I am grateful include the museum curators who searched their records and provided helpful information, the many wildlife professionals who contributed their knowledge and personal interest not only through the questionnaire but also in the field, and the many farmers and rural landowners who responded to the survey and provided access to their land.

I express appreciation to my parents, Thane and Susan Hatcher, for their continuous support throughout my development.

I express deepest appreciation to my wife, Elizabeth, for her understanding, encouragement and belief in me.

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DISTRIBUTION, RELATIVE ABUNDANCE, AND POPULATION STATUS OF RED FOXES IN OKLAHOMA[1]

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ABSTRACT. Data regarding red fox (Vulpes vulpes) distribution, relative abundance and population trend were collected from museum records, questionnaires to professional wildlife personnel and field observations. With the possible exception of the panhandle, red foxes occur statewide in apparent low abundance. Greatest abundance occurs in the oak-hickory forest ecoregion in northeastern Oklahoma. Red fox numbers were reported to be decreasing (45.4%) or stable (27.3%) by most of the questionnaire respondents, although many (26.2%) of the respondents did not answer the question regarding population trend.

The most recent statewide survey of red foxes in Oklahoma (Glass and Halloran 1960) used museum records and a mail survey to show that

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[1]Research was supported by Pittman-Robertson Project W-129-R, Study 2, Job 1, Oklahoma Department of Wildlife Conservation in cooperation with the Oklahoma Cooperative Wildlife Research Unit.

red foxes occurred primarily in the eastern one-third of Oklahoma. Glass and Halloran also reported a westward range extension, but noted that the red fox was rare in the western 1/2 of the state. Deems and Pursley (1978) however, in an extensive survey of North American furbearers, reported red foxes limited only to the eastern 1/4 of Oklahoma. Other surveys (Blair 1939, Duck and Fletcher 1944, Hall and Kelson 1959) generally reported red foxes distributed in eastern Oklahoma, primarily in the extreme eastern forested areas.

High fur prices, heavy harvest pressure and impressions of low densities led the Oklahoma Department of Wildlife Conservation to close the harvest of red foxes and to request assistance in determining the status of the species. The primary objective of the study was to determine the distribution of red foxes in Oklahoma. Secondary objectives were to determine the relative abundance of red foxes in different regions of Oklahoma, and to determine the population trend.

METHODS. Museum and Refuge Records. Records of red fox specimens were requested from 11 museums maintaining mammal collections from Oklahoma. Red fox records were also requested from the 6 national wildlife refuges in the state.

Questionnaire and Observation Forms. A 1-page questionnaire was mailed to personnel of the Oklahoma Department of Wildlife Conservation, the U. S. Fish and Wildlife Service Animal Damage Control Division and the U. S. Army Corps of Engineers Projects in Oklahoma. The questionnaire included a request for the number of red foxes seen per year within the last 2-3 years in the employee's area of responsibility (usually county). Five possible responses were provided: None, 1-2, 3-5, 6-10, over 10. Median response values (1.5, 4, 8, arbitrary 12)

were averaged by county and across adjacent counties having similar positive responses. These area averages were used to indicate relative abundance. Professional wildlife personnel were also asked whether red fox populations were stable, increasing, or decreasing.

Two observation forms for reporting red foxes seen during the current year (1977) were mailed with the questionnaire. Assuming observation forms were mailed uniformly across ecoregions (Bailey 1976), a chi-square test of constancy was performed on the number of observation forms received over ecoregions. Expected values were derived from the proportional area of each ecoregion. Mesquite-buffalo grass ecoregion was excluded from analysis and bluestem prairie was combined with bluestem-grama prairie because of the relatively small area the former 2 ecoregions occupy, and to increase the small expected values in each chi-square cell. Bluestem prairie and bluestem-grama prairie are considered parts of a major region.

Two postage-paid envelopes were included in the first mailing. A second mailing to nonrespondents followed the first mailing by 1 month.

Additional Sightings. Additional sightings of red foxes were collected through personal field observations, observations by other wildlife researchers and professional wildlife personnel that had not returned an observation form on a sighting.

RESULTS. Museum and Refuge Records. Unpublished records of 14 red foxes were received from 6 museum collections. Because of possible recent changes in distribution patterns, only the specimens collected since 1972 (7 of the 14) are reported (Table 1). In addition 2 road-killed red foxes were catalogued in the OSU museum during this study (Table 1). Locations of these 9 recent specimens are shown in Fig. 1.

TABLE 1

Recent unpublished museum records of red foxes (Vulpes vulpes) in Oklahoma

Collection Date	County	Location	Museum
Fall 1972	Kay	Tonkawa city limits	Northern Okla. College, Tonkawa
1 Jul 1972	Bryan	3 mi E Durant	Southeastern Okla. State Univ., Durant
1 Jul 1972	Bryan	3.5 mi E Durant	Southeastern Okla. State Univ., Durant
Oct 1976	Alfalfa	1 mi N Cherokee	Northwestern Okla. State Univ., Alva
11 Jul 1977	Kiowa	2 mi E Snyder	Okla. State Univ., Stillwater
10 Oct 1977	Kiowa	4 mi W Snyder	Cameron Univ., Lawton
5 Jan 1978	Kingfisher	0.75 mi E Kingfisher	Okla. State Univ., Stillwater
1 Feb 1978	Tillman	1 mi NE Frederick	Cameron Univ., Lawton
19 Jun 1978	Jackson	3 mi N Altus	Cameron Univ., Lawton

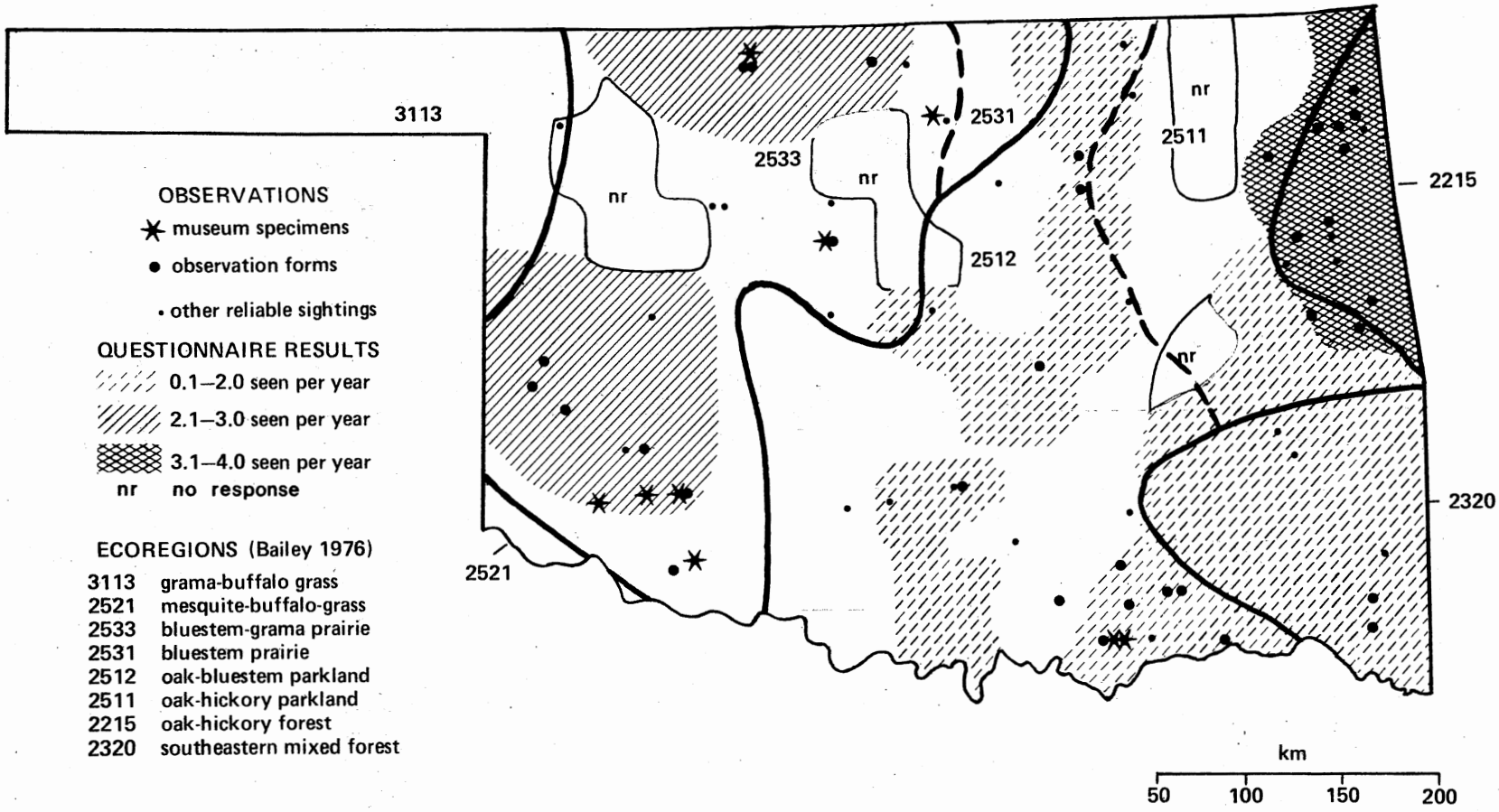

Fig. 1. Red fox distribution in Oklahoma, 1976-78 (museum specimens since 1972).

Four responses were received from national wildlife refuges. No definite records of red foxes were reported; only an unconfirmed sighting on the Optima National Wildlife Refuge by a local resident was mentioned.

Questionnaires. Of 209 questionnaires mailed to personnel of the Oklahoma Department of Wildlife Conservation and U. S. Fish and Wildlife Service, 170 (81.3%) were returned. An undetermined number of copies of the questionnaire was sent through the U. S. Army Corps of Engineers office to each of the 23 Corps of Engineers Projects in Oklahoma. Thirteen responses were received for a total of 183 questionnaires analyzed.

Fifty-one respondents (28%) reported seeing 1 or more red foxes within the past 2-3 years (Table 2). Only 8.3% had seen more than 2 red foxes per year. One individual reported observing over 10 red foxes per year.

Red foxes were reported in all ecoregions except the mesquite-buffalo grass ecoregion, a small area of southwestern Oklahoma (Fig. 1). The statewide mean was 0.7 red foxes per respondent seen per year. By ecoregion, the largest mean number seen per year (3.4) occurred in the oak-hickory forest ecoregion in northeastern Oklahoma.

Only 2 of the 183 respondents thought red fox populations were increasing locally (Table 2). One was from eastern and the other was from western Oklahoma. The greatest proportion (45.4%) of respondents reported that red foxes were declining. Twenty-six percent did not respond to the question, compared to 0.5% who did not answer the first question about sightings.

TABLE 2

Frequency of response to questions about red foxes

	Responses	Frequency	Percentage
Number of red foxes seen per year within last 2-3 years in area of responsibility.	None	131	71.6
	1-2	36	19.7
	3-5	10	5.5
	6-10	4	2.2
	over 10	1	0.5
	no response	1	0.5
Are red foxes stable, increasing, or decreasing in your area of responsibility?	stable	50	27.3
	increasing	2	1.1
	decreasing	83	45.4
	no response	48	26.2

Observation Forms. Forty-five forms reporting observations of red foxes were received. One form reported a sighting during 1978, 27 during 1977, 7 during 1976, and 7 prior to 1976. Three forms contained reports by local residents to the wildlife employee. Locations of the 34 observations by wildlife personnel from 1976-1978 are shown in Fig. 1.

Chi-square analysis revealed a significant difference among ecoregions in the number of recent red fox sightings reported by wildlife personnel on observation forms ($P < .01$, $x^2 = 34.1$, 5 d.f.). Eighty-six percent of the total chi-square value came from the disproportionately high number of observations in the oak-hickory forest ecoregion.

Additional Sightings. Twenty-seven red fox sightings since 1976 by myself, other wildlife researchers, and professional wildlife personnel that did not return an observation form on the sighting were obtained (Fig. 1).

DISCUSSION. Distribution. Red foxes were distributed throughout Oklahoma with the possible exception of the panhandle. Although there were no confirmed red fox sightings in the panhandle, 2 unconfirmed reports of sightings by local residents were received. Reference has been made to the first report on the Optima National Wildlife Refuge near Hardesty. A sighting of a pair of red foxes either in 1973 or 1974 near Boise City was also received. No subsequent sighting of the pair near Boise City was made.

The forest ecoregions in eastern Oklahoma constitute the primary historical red fox range in the state. Red foxes still appear to be widespread through these regions, although apparently in fewer numbers in the southeastern mixed forest than in the oak-hickory forest.

Many observation forms were received from locations west of the forested ecoregions where no red foxes had been seen in the past 2-3 years. Similarly, some areas where red foxes had been seen in the past 2-3 years yielded no sightings during the current year. Variability in sightings probably reflects the low red fox abundance. Numerous first-hand reports of red fox importations into the state for sport running may also partly account for the variability in sightings. Martin and Preston (1970) obtained reports from landowners of red fox introductions in extreme southwestern Oklahoma (Harmon County). Other investigators (Glass and Halloran 1960, Butler 1972) also received reports of red fox releases.

Reports of red foxes, including museum specimens, were received from several counties west of those reported by Glass and Halloran (1960). Range expansion, increased detection through more intensive sampling, or a combination may be responsible for the range extension. Janes and Gier (1966) mentioned red fox sightings in western Kansas from approximately 1940. They believed the increase in records of red foxes since 1955 indicated both a westward range expansion and more intensive study. Glass and Halloran (1960) suggested a similar expansion in Oklahoma.

Relative Abundance. Relative abundance of red foxes was difficult to determine due to differences in interest and experience in respondents as well as variation in visibility across the state. Reports of red foxes were too widely scattered across most regions to indicate relative abundance across the major portion of the state. Questionnaire results showed more red foxes seen in certain areas of the bluestem-grama prairie than in the oak-bluestem parkland. Locations reported on observation forms were 1 fewer in the bluestem-grama prairie than in the

oak-bluestem parkland, however, and the difference between ecoregions could easily be due to increased visibility in the prairie region.

Conversely, both questionnaire results and analysis of observation forms indicated that the greatest red fox abundance in Oklahoma occurs in the oak-hickory forest ecoregion of northeastern Oklahoma. A visibility bias would result in an underestimate of relative abundance in this region.

The lack of verified sightings of red foxes in the panhandle, only 1 sighting in the grama-buffalo grass ecoregion extending east from the panhandle, and the relatively high visibility in this region indicates that red foxes are rare if they occur in the grama-buffalo grass ecoregion in Oklahoma.

Population Trend. The greatest percentage of respondents reported a decreasing red fox population. However, 27.2% of the respondents did not answer the question, and most respondents had not recently seen red foxes. The high nonresponse to the status question probably reflects both the honesty of the wildlife personnel in their being unable to appraise red fox population trends as well as their belief that there were no red foxes in their areas. Red foxes may be decreasing in numbers in part of all of Oklahoma. Other surveys designed to monitor annual population changes should be employed to confirm this trend.

Appreciation is extended to the many wildlife professionals, museum curators and other interested residents who contributed their time and knowledge to this survey. I thank J. H. Shaw, my major adviser, committee members, J. A. Bissonette, B. P. Glass and P. A. Vohs, and W. D. Warde for helpful suggestions. J. H. Eve provided assistance and

coordination with the Oklahoma Department of Wildlife Conservation. D. L. Peters assisted in data collection.

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COMPARISON OF 3 INDICES TO FURBEARER POPULATIONS[1]

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Abstract: The effectiveness and cost of a farm operator mail survey (FOS) and 2 scent station surveys, 1 with random (RSSS) and 1 with non-random (NSSS) route selection, were compared in 5 Oklahoma counties. Similarities between indices of the FOS and NSSS were apparent for coyotes (Canis latrans) and foxes (Urocyon cinereoargenteus and Vulpes vulpes), but not for bobcats (Lynx rufus). At the sampling intensities used, the RSSS had the lowest index values and limited effectiveness in detecting the presence of a target species. The FOS had the highest response rates and cost less than the scent station surveys to conduct.

Increasing fur prices and heavy harvest pressure have focused attention on the importance of monitoring furbearer population changes. Of the many survey methods developed, mail surveys and scent station

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[1]Contribution from Pittman-Robertson Project W-129-R, Study 2, Job 1, in cooperation with the Oklahoma Department of Wildlife Conservation and Oklahoma Cooperative Wildlife Research Unit.

surveys seem to be promising for management of upland furbearers because of their relative low cost and ease in sampling large areas.

Linhart and Knowlton (1975) adapted the scent station survey as an index to relative abundance of coyotes. They cautioned that the method would probably require modification to obtain abundance data for other species. Scent station surveys with and without modifications are in use among state wildlife agencies to monitor simultaneously several furbearer populations.

Mail questionnaires have been used for years as an inexpensive method of monitoring many species, including furbearers (Lemke and Thompson 1960, Pils and Martin 1978). Filion (1978) recently discussed several factors for increasing effectiveness of mail surveys.

This study compares the effectiveness and cost of a (1) farm operator mail survey, (2) scent station survey with stratified random route selection, and (3) scent station survey with nonrandom route selection.

The helpful comments of P. A. Vohs, J. A. Bissonette, B. P. Glass, W. D. Warde and J. H. Eve are acknowledged. The Oklahoma Department of Wildlife Conservation generously permitted use of their scent station survey data. The U.S.D.A. Agricultural Stabilization and Conservation Service (ASCS) provided access to county farm operator lists after conditions of the 1973 Privacy Act had been met. Thanks are also extended to the many farm owners and managers whose interest provided assistance in completing this questionnaire.

METHODS

Five counties were selected for this survey to include major ecoregions (Bailey 1976), and where independent surveys had confirmed the

presence of red foxes (Table 1). This confirmation was necessary because of apparent low red fox abundance in Oklahoma.

Farm Operator Survey (FOS)

Six hundred names per county were randomly selected for the FOS from county ASCS files of farm operators (owners and/or managers). The business reply postcard questionnaire mailed 15 June requested information regarding coyotes, bobcats, red foxes, gray foxes, and unidentified species of fox on lands owned or managed in 1978 (Fig. 1). Respondents were offered a survey summary at the conclusion of the study in an effort to maximize the response rate. A cover letter provided brief physical descriptions of each species, and included a telephone number for inquiries about the survey. An additional questionnaire was sent to nonrespondents 1 month after the first mailing.

Random Scent Station Survey (RSSS)

Five 3.3 mi (5.3 km) scent station routes were selected along unpaved roads in each of the 5 counties. Land use within each county was determined from Soil Conservation Service land use maps, and routes were randomly selected within each principal land use type. A 3 mi (4.8 km) limit between routes was maintained to minimize the chance of 1 animal being recorded on 2 routes.

Each route consisted of 12 scent stations spaced at 0.3 mi (0.48 km) intervals on alternate sides of a road. A mixture of fatty acids developed by the U. S. Fish and Wildlife Service was applied to a cotton swab at each station. The last 2 stations on each route were not counted unless 1 or 2 of the first 10 stations were obliterated. Station visits

Table 1. Characteristics of 5 counties selected for surveys.

County	Ecoregion (Bailey 1976)	Percentage of county in forest (Moser 1976)
Kiowa	Bluestem-grama prairie	2.4
Canadian	Bluestem-grama prairie/oak + bluestem parkland	3.4
Atoka	Oak + bluestem parkland/ southeastern mixed forest	22.5
Delaware	Oak-hickory forest	39.7
Latimer	Southeastern mixed forest	69.2

CARNIVORE SURVEY

1. How many acres do you manage (that is, own or operate) in Delaware County?_____

	CHECK ONE	
2. On the area you manage,		
a. have you seen any *coyotes* this year?	Yes ☐	No ☐
b. are you aware of any *coyote dens*?	Yes ☐	No ☐
c. if so, how many dens?_____		
3. On the area you manage,		
a. have you seen any *bobcats* this year?	Yes ☐	No ☐
b. are you aware of any *bobcat dens*?	Yes ☐	No ☐
c. if so, how many dens?_____		
4. On the area you manage,		
a. have you seen any *red foxes* this year?	Yes ☐	No ☐
b. are you aware of any *red fox dens*?	Yes ☐	No ☐
c. if so, how many dens?_____		
5. On the area you manage,		
a. have you seen any *gray foxes* this year?	Yes ☐	No ☐
b. are you aware of any *gray fox dens*?	Yes ☐	No ☐
c. if so, how many dens?_____		
6. On the area you manage,		
a. have you seen any *foxes* this year, but are not certain which kind?	Yes ☐	No ☐
b. are you aware of any *fox dens*, but not certain which kind of fox?	Yes ☐	No ☐
c. if so, how many dens?_____		

If you would like a summary of the results on this project, check here. ☐
Thank you for your help. Please drop this card in the mail as soon as possible.

Fig. 1. Example of farm operator survey questionnaire.

were recorded for 2 consecutive nights (100 scent station-nights). The RSSS was conducted in July and August along the same routes.

Nonrandom Scent Station Survey (NSSS)

The Oklahoma Department of Wildlife Conservation conducted scent station surveys in all 77 Oklahoma counties during August 1978. These surveys consisted of 1 to 3 routes totaling 15 mi (24 km) per county. Routes were subjectively selected by local wildlife personnel. The same type of scent was used as in the RSSS, and the 50 stations per county were examined 2 consecutive nights (100 scent station-nights).

RESULTS

FOS

Sixteen hundred forty (54.7%) of the 3,000 questionnaires mailed were returned. Forty returned questionnaires were eliminated because of duplications or changes of address. The response rate for each county was similar but the total area sampled varied widely (Table 2). Overall, 58.3% of the respondents requested the results and only 2 telephone inquiries were received.

The percentage of respondents aware of dens was roughly proportional to the percentage of respondents sighting each of the species (Table 3). The former values were quite low, however, except for coyote dens.

Sightings of coyotes were more frequent than of any other species surveyed. Coyotes, and to a lesser extent bobcat, sightings decreased in more heavily forested counties. More respondents reported red foxes in the 3 forested counties, especially Delaware County in the oak-hickory forest ecoregion. A positive relationship between closed canopy and gray fox sightings is apparent.

Table 2. Summary statistics of farm operator survey by county.

	County				
	Kiowa	Canadian	Atoka	Delaware	Latimer
No. questionnaires mailed	600	600	600	600	600
No. (%) valid respondents	346 (57.7)	348 (58.0)	307 (51.2)	292 (48.7)	307 (51.2)
Adjusted area (A) sampled (% of county area)*	279512 (42.2)	181489 (31.4)	110560 (17.3)	59099 (11.9)	55677 (11.8)
$\bar{X}$ farm size (A) per respondent	807.8	521.5	360.1	202.4	181.4

*Many respondents did not report their farm size. The mean county farm size was used in these cases to estimate the total area sampled by county.

Table 3. Results of farm operator surveys in 5 Oklahoma counties, 1978.

Question	Percent response, no. dens and range by county				
	Kiowa	Canadian	Atoka	Delaware	Latimer
On the area you operate, during 1978,					
Seen coyotes (%)	80.9	81.4	67.5	57.7	43.7
Aware of coyote dens (%)	16.6	25.9	16.6	13.8	8.7
No. coyote dens	88	193	56	77	48
Range of responses to no. coyote dens	1-4	1-24	1-4	1-10	1-10
Seen bobcats (%)	25.3	21.3	19.8	10.0	14.0
Aware of bobcat dens (%)	2.2	1.8	1.7	1.8	0.8
No. bobcat dens	9	4	11	5	6
Range of responses to no. bobcat dens	1-3	2	1-6	1-2	2
Seen red foxes (%)	16.3	4.3	12.7	32.5	10.5
Aware of red fox dens (%)	5.8	1.5	1.8	5.7	2.7
No. red fox dens	24	3	4	17	4
Range of responses to no. red fox dens	1-4	1-2	1-2	1-3	1-2
Seen gray foxes (%)	4.9	2.2	19.4	22.6	18.1
Aware of gray fox dens (%)	1.1	0.4	0.9	2.3	2.8
No. gray fox dens	3	0	6	6	12
Range of responses to no. gray fox dens	1	0	1-2	1-2	1-4
Seen fox, not sure which kind of fox (%)	7.3	3.8	8.5	8.4	11.2
Aware of fox dens (%)	2.4	1.9	1.4	2.1	2.9
No. fox dens	7	25	5	7	3
Range of responses to no. fox dens	1-3	1-24	1-2	1-2	1

Scent Station Surveys

Four hundred ninety and 495 scent station-nights were recorded for July and August RSSS, respectively. Road graders obliterated 15 stations. Coyote, bobcat and fox visits recorded on the NSSS are reported here only for the 5 sample counties, 494 scent station-nights (Figs. 2-5).

Fox visits were not recorded by species on the NSSS because of difficulty in distinguishing among tracks of fox species (Murie 1954). Because fox species were pooled for the NSSS, provisions were made to combine them for the FOS and the RSSS for comparison.

Index values (number of visits ÷ number of operable stations) for the RSSS were lower than for FOS and NSSS (Figs. 2-4). Only coyotes visited RSSS scent stations in all 5 counties, no more than 2 bobcat visits were recorded in any county and only 2 fox visits (1 red fox in Canadian County, 1 gray fox in Delaware County) were obtained. No relationship between index values and county characteristics was apparent.

NSSS index values were higher than RSSS index values for coyotes, bobcats and foxes in all counties, except for coyote visits in Latimer County. Coyote visits were fewer in the more forested counties. Bobcat visits varied little among counties. Fox visits were higher in the 3 forested counties.

Costs

Costs of conducting RSSS and NSSS were similar (Table 4). FOS was least expensive. Fewer man-hours are involved in the FOS than RSSS and presumably NSSS.

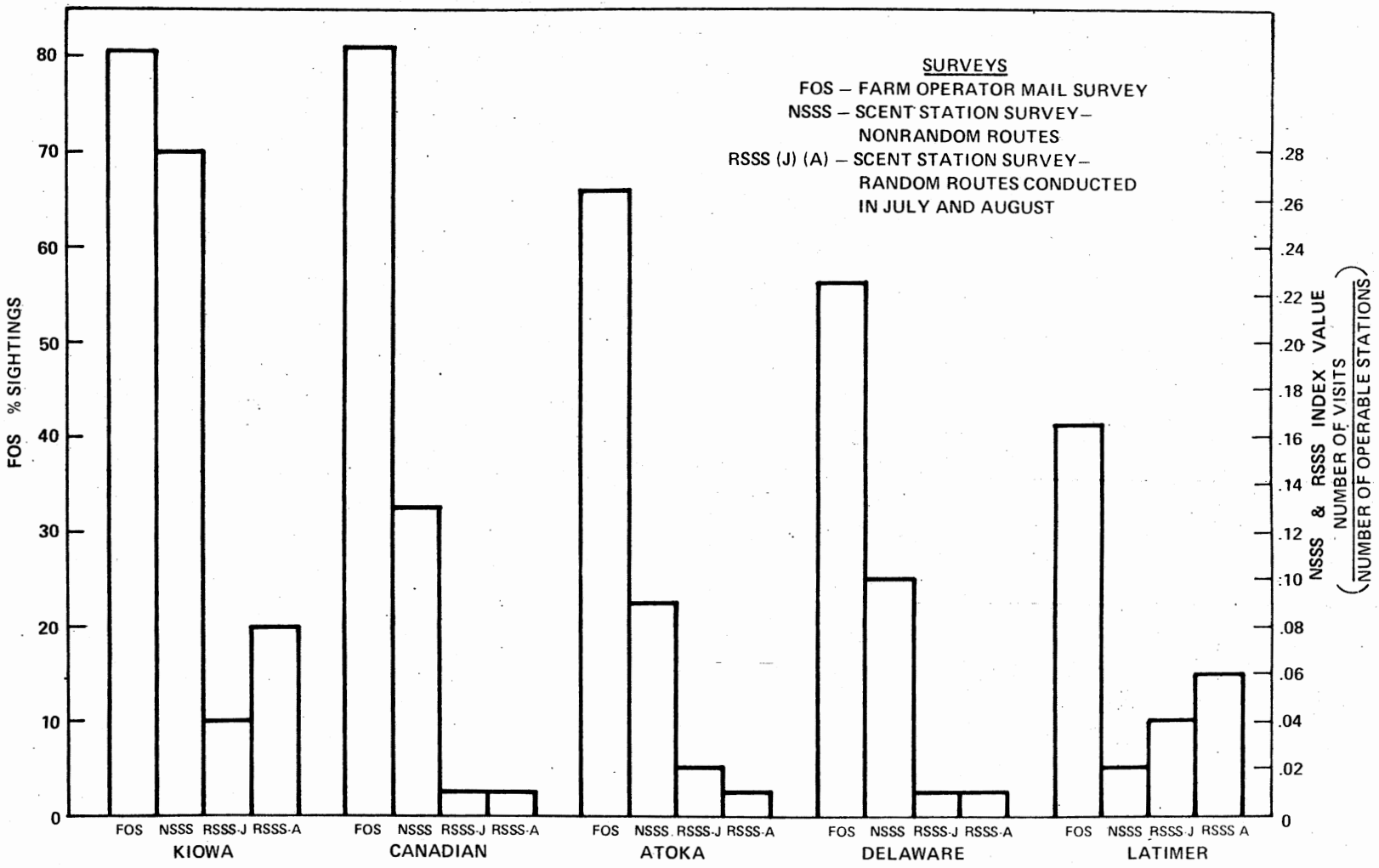

Fig. 2. Indices to coyote populations from 3 survey methods in 5 Oklahoma counties.

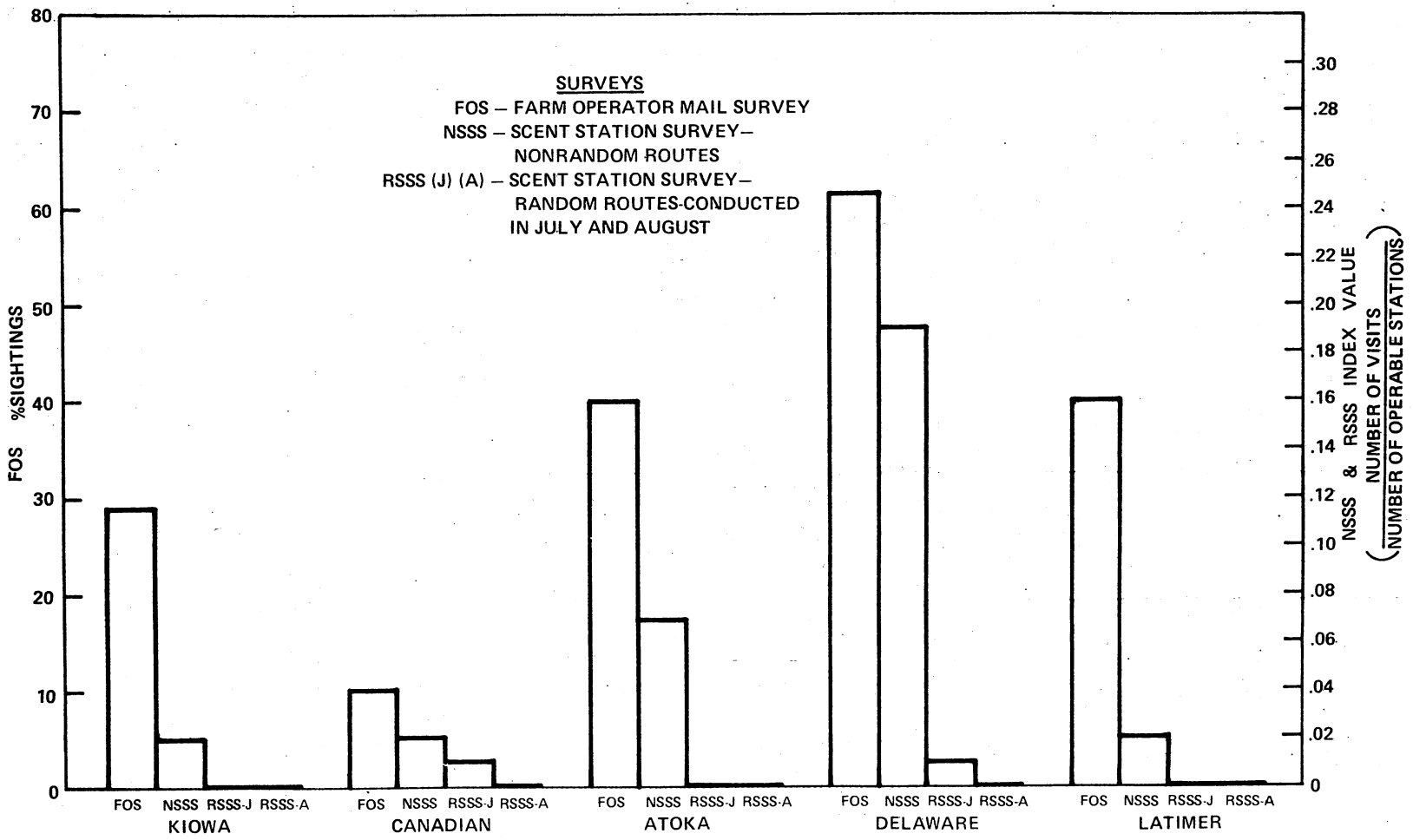

Fig. 3. Indices to fox populations from 3 survey methods in 5 Oklahoma counties.

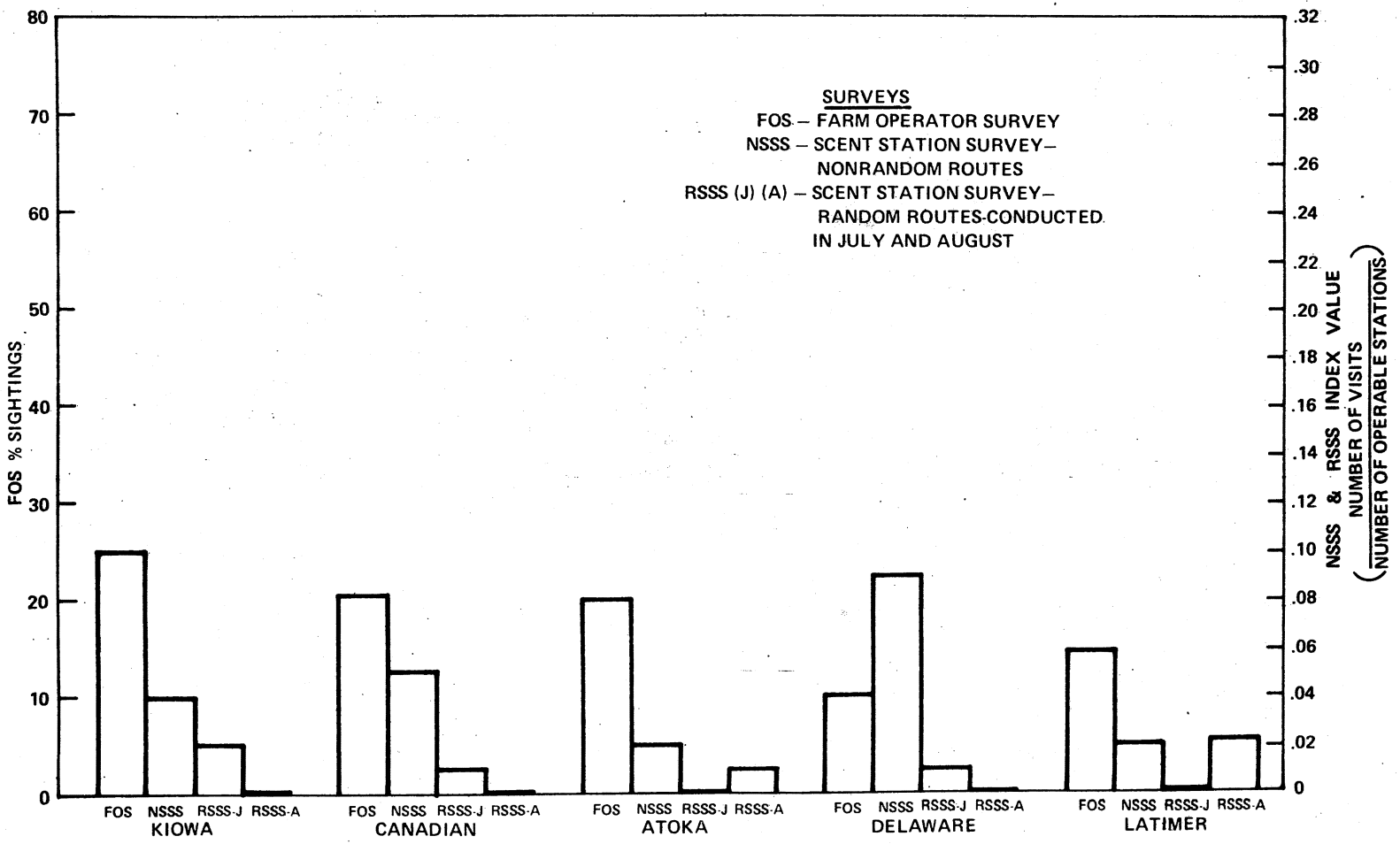

Fig. 4. Indices to bobcat populations from 3 survey methods in 5 Oklahoma counties.

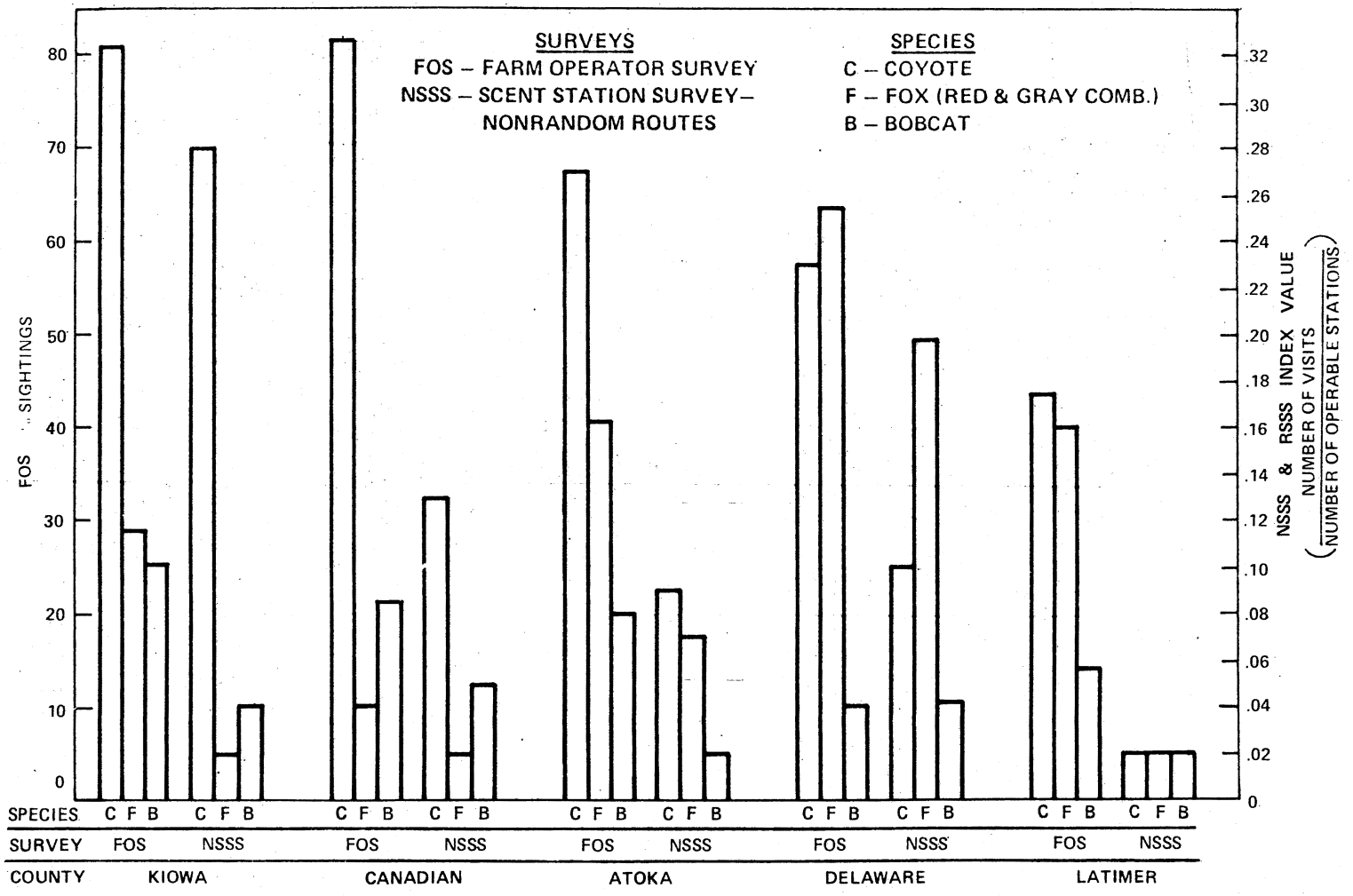

Fig. 5. Indices to coyote, fox, and bobcat populations from 2 survey methods in 5 Oklahoma counties.

Table 4. Relative cost of 3 furbearer survey methods.

	Farm operator survey	Random scent station survey	Nonrandom scent station survey
$\bar{X}$ cost per county (includes materials, travel, mileage and/or postage)	$265.00	$355.00	$364.00*
Man-hours per county	18	40	--**

*Approximation from Eve, J. H. (1978).

**Data not available.

DISCUSSION

Similar patterns between indices from FOS and NSSS were apparent among counties for coyotes and foxes, but not for bobcats. A comparison within counties of relative values of coyotes, bobcats and foxes also showed definite similarities between FOS and NSSS. RSSS had greatest coyote index values in Kiowa County as did NSSS, but RSSS index values were generally too low to detect similarities.

Effectiveness

Both FOS and NSSS detected the presence of coyotes, foxes and bobcats in all 5 counties. The RSSS detected the presence of coyotes in the 5 counties surveyed. Foxes and bobcats were not detected by the RSSS in all counties during either survey period, however, indicating limited effectiveness of this method at the sampling intensity used. More domestic dog (67%) and housecat (300%) visits were recorded on the RSSS than the NSSS, suggesting that random survey routes are more likely to pass near occupied houses. This may have reduced the detection of wild furbearers by RSSS.

Although the indices of FOS and NSSS were not directly comparable, higher response rates on the FOS implied that the presence of target species may be detected at lower population levels with the FOS than the NSSS at the sampling intensities used. Using a survey similar to the FOS, Lemke and Thompson (1960) found a significant correlation ($p < .01$) between percentage of respondents sighting foxes on their farms and the number of foxes bountied over a 7 year period, suggesting the reliability of sightings reported on mail surveys to detect annual population changes.

The high positive response rate for coyotes in Kiowa and Canadian counties, however, indicated that effectiveness of the FOS has an upper limit. Future coyote population increases could not be detected if every respondent in the county had already seen a coyote on his farm.

The number of dens reported on the FOS is potentially more valuable than percentage of sightings because the area sampled is reported, permitting den densities to be estimated. However, except for the coyote data, the percentage of respondents aware of dens was less than 6% in all 5 counties. This frequency was too low for accurate interpretation.

Results of the 3 survey methods could be affected by selection of sampling intensities. The actual area sampled with a scent station survey is unknown, and optimum sampling levels have not been determined. Conducting scent station surveys in September or October might also increase index values because of increased animal movements and activities, but results are often needed for setting harvest regulations, and increased fall precipitation would hamper use of the technique.

Habitat

Limitations on visibility related to vegetation may have biased sightings reported on the FOS and affected the apparent inverse association of coyotes to forested ecoregions. However, data for foxes showed a higher percentage of sightings in more forested counties, where visibility should have been reduced. The overall similarity between the FOS and NSSS of indices for both coyotes and foxes further indicated that differences in visibility had little influence on FOS results. One reason why differences in visibility may not greatly affect the indices of the FOS could be the relationship between habitat

conditions and farm sizes. A smaller farm size might increase the chance of observing an animal in that area despite increased areas of forest.

Species

The least consistent results between methods occurred with bobcat indices. Perhaps the cryptic nature of bobcats reduces the effectiveness of direct sightings as an index of density. Also, the scent, developed for coyotes, may be less attractive to bobcats.

Cost

The FOS will cost less than scent station surveys to conduct. Clerical labor can manage the FOS operation, but specialized professional labor is needed for the major portion of the scent station surveys.

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APPENDIXES

APPENDIX A

COVER LETTERS, FOLLOWUP LETTERS, QUESTIONNAIRE AND OBSERVATION FORM USED IN DETERMINATION OF RED FOX STATUS

Oklahoma State University

SCHOOL OF BIOLOGICAL SCIENCES

STILLWATER, OKLAHOMA, 74074
(405) 624-5555

We are involved in an extensive red fox study financed by the Oklahoma Department of Wildlife Conservation through the Oklahoma Cooperative Wildlife Research Unit, to determine the status and distribution of red foxes in Oklahoma, and to evaluate survey methods for this animal. As a part of this project, we are investigating population trends of the red fox as well as those of other sympatric carnivores. We would especially be interested in obtaining information from the refuges in the state, since these are the only areas where continual and reliable records are kept on carnivore observations.

Towards this end, we would like from your records the occurrences of red foxes since the establishment of your refuge. Please include dates whenever possible. Of secondary interest is the occurrence and abundance of bobcats, gray foxes, coyotes and raccoons. We would appreciate your overall impressions concerning changes in abundance of these animals on your refuge, and land use changes in surrounding areas of which you are aware.

Enclosed are observation forms for the reporting of red fox sightings since 1 January 1977. If red foxes have not been seen this year, please maintain the form for future sightings.

Thanks for all your able help. We'll be certain that you get a copy of the results when they are compiled. We welcome any other correspondence regarding red foxes or survey methodology.

Yours truly,

Richard Hatcher
Research Assistant

James H. Shaw
Assistant Professor

Oklahoma State University
SCHOOL OF BIOLOGICAL SCIENCES
STILLWATER, OKLAHOMA, 74074
(405) 624-5555

June 17, 1977

Dear Sir:

We are involved in a study financed by the Oklahoma Department of Wildlife Conservation through the Oklahoma Cooperative Wildlife Research Unit, to determine the status and distribution of the red fox in Oklahoma, and to evaluate survey methods for this animal. Your help in providing information will be an important first step towards these ends.

We have enclosed a brief questionnaire, and would appreciate your assistance in completing it. Please return the completed questionnaire at your earliest convenience, even if you have never seen any red foxes in your county. Also enclosed are observation forms for the reporting of future sightings. If you have made observations of red foxes since 1 January, 1977, please complete the form for your previous sighting and return it. If you have not seen red foxes as yet, please maintain the form, complete it upon sighting a red fox and return the completed form to us at that time. Additional forms will be mailed to you upon return of a completed form or upon request.

Thanks for all your able help. We'll be certain that you get a copy of the results when they are compiled. Just list your address on the completed form when you return it. We welcome any other correspondence regarding red foxes or survey methodology.

Yours truly,

Richard Hatcher
Research Assistant

James H. Shaw
Assistant Professor

RH/bd

Enclosure

Oklahoma State University

SCHOOL OF BIOLOGICAL SCIENCES

STILLWATER, OKLAHOMA, 74074
(405) 624-5555

July 29, 1977

Dear Sir:

I am involved in a red fox survey, sponsored by the Oklahoma Department of Wildlife Conservation through the Oklahoma Cooperative Wildlife Research Unit. The first week in July you should have received a questionnaire and observation forms regarding red foxes in your area to be completed and mailed to me. Since I have not received this information, I have enclosed another questionnaire. Please complete the questionnaire and return it at your earliest convenience, even if there are no red foxes in your area.

Also enclosed is an observation form for the reporting of red foxes since January 1, 1977. If you have not seen red foxes as yet, please maintain the form, complete it upon sighting a red fox, and return the completed form at that time.

Thanks for your help. I'll be certain that you get a copy of the results when they are compiled. Just list your address on the completed questionnaire when you return it.

Yours truly,

Richard Hatcher

Richard Hatcher
Research Assistant

RH:mr

QUESTIONNAIRE

Name: Position:

Address and phone number:

County(ies) or Game Management Area:

How many years have you worked in this area?

About how many red foxes (including road kills) did you see per year in your area within the last two or three years? (Circle your choice)

None (1-2) (3-5) (6-10) (over 10)

How many sets of red fox tracks have you seen per year in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

How many reports of red fox sightings did you get per year by landowners or sportsmen in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

How many bobcats (including road kills) have you seen per year in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

How many sets of bobcat tracks did you see per year in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

How many gray foxes (including road kills) have you seen per year in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

How many sets of gray fox tracks did you see per year in your area within the last two or three years?

None (1-2) (3-5) (6-10) (over 10)

Would you consider the following species in your area to be stable, increasing or decreasing? (Circle your choice)

red fox	stable	increasing	decreasing
gray fox	"	"	"
bobcat	"	"	"
coyote	"	"	"
raccoon	"	"	"

Your overall impressions concerning changes in distribution and abundance of red foxes, gray foxes, and/or bobcats in your area over the past 15 years.

(Use back of form)

RED FOX OBSERVATION FORM

Observer's Name:

Position:

Address and phone number:

Date of observation:

Time:

County:

Exact location (Township, Range and Section if possible, or directions from nearest town on state highway map):

Other:

Total number observed: Adults _____ Young _____

General appearance of animal(s): (circle) unable to determine healthy

emaciated mangy other:

Description of observation: (circle)

sighted alive along road	road kill
sighted alive in cultivated field	sighted at den
sighted alive in grassland	trapped
sighted alive in woodland	other (specify):

Other comments:

Please return form to Richard Hatcher, 402 Life Sciences West, Oklahoma State University, Stillwater, OK 74074

APPENDIX B

LIST OF MUSEUMS CONTACTED AND ALL UNPUBLISHED RED FOX SPECIMEN RECORDS

LIST OF THE MUSEUMS CONTACTED REGARDING

RED FOXES, AND RESPONSES

Museum	Status
1. Dr. William Carter East Central State University Museum Ada, OK 74820	1. Pontotoc County, SW edge of Ada at Lawrence school house 2 February 1965, coll. by J. McPhetridge
2. Dr. Bill Pitts, Curator Northwestern Oklahoma State University Museum Jesse Dunn Hall Ada, OK 73717	1. Alfalfa County, Ingersoll city limits, shot 25 November 1964 (from field notes); museum record: 25 November 1965 is incorrect. 1067-402-178-99 MM, lbs. #5176, coll. by R. Mayer 2. Alfalfa County, N of Cherokee October 1976 specimen frozen, coll. by D. Jobes
3. Dr. John K. Greer, Director and Curator of Mammals Stovall Museum of Science and History University of Oklahoma 1335 Asp St. Norman, OK 73069	No Oklahoma red foxes.
4. Dr. Leo Rodriquez, Director Northern Oklahoma College Museum 1220 E. Grand Tonkawa, OK 74653	1. Kay County, Tonkawa city limits fall 1972 2. Kay County, 1 mi W, 2.5 mi N Northern Oklahoma College, 5 November 1940
5. Dr. C. O. Hadley National Museum of Natural History Washington, DC 20560	No Oklahoma red foxes.
6. Dr. Robert S. Hoffman Museum of Natural History Systematics Museums University of Kansas Dyche Hall Lawrence, KS 66044	No Oklahoma red foxes.

Museum	Status
7. Dr. Robert J. Baker, Curator Mammalogy The Museum of Texas Tech Univ. P. O. Box 4499 Lubbock, TX 79409	No Oklahoma red foxes.
8. Dr. Frank Blair Dept. of Zoology University of Texas at Austin Austin, TX 78712	No Oklahoma red foxes seen or collected by Blair.
9. Dr. Jack Tyler Biology Department Cameron University 2800 Gore Boulevard Lawton, OK 73501	1. Pittsburg County, near Krebs, in 1960's, #327, coll. by J. Pickens 2. Kiowa County, 4 mi W of Snyder, 10 October 1977, #550, female, skull only, coll. by C. Garber 3. Tillman County, 1 mi NE of Frederick, 1 February 1978, male, #554, skin and skull, coll. by R. Bohannon 4. Jackson County, 3 mi N of Altus, 19 June 1978, #551, tail only, coll. by J. Reed
10. Dr. Kirkpatrick Biology Department Southeastern Oklahoma State University Durant, OK 74701	1. Bryan County, Colbert, 27 December 1969, male, 19 lbs, 49-29-13-6 inches, #68, skull and skin 2. Bryan County, 3.5 mi E Durant, 1 July 1972, male, 35 3/4-15 1/2-2 3/4 in, 7 3/4 lbs, #246, skull only 3. Bryan County, 3 mi E Durant, 1 July 1972, male, 37-14 1/2-3-1 1/4 in, #247, skin and skull
11. Oklahoma State University Museum 402 Life Sciences West Stillwater, OK 74074	1. Adair County, 4 mi N of US 62 on Tyner Creek, 23 July 1950, #2128 2. Latimer County, Brushy Narrows, summer 1952, #1924

Museum	Status
	3. Payne County, near Stillwater, 19 July 1953, #2114
	4. Payne County, E side Stillwater, 2 May 1956, #3639
	5. Payne County, 2 mi E Stillwater, 29 October 1956, #3334
	6. Marshall County, Lake Texoma, 10 July 1957, #3265
	7. Okmulgee County, April 1959, #4116
	8. Pushmataha County, 6 mi S Clayton, 19 April 1959, #3871
	9. Delaware County, 4 mi W, 2.5 mi N Jay, 2 February 1969, #9136
	10. Kiowa County, 2 mi E Snyder, 11 July 1977 #10522, skull fragments only
	11. Kingfisher County, 0.75 mi E Kingfisher, 5 January 1978
	12. Hughes County, 3 March 1960, #4355

APPENDIX C

ADDITIONAL RESULTS OBTAINED FROM SURVEY QUESTIONNAIRE TO PROFESSIONAL WILDLIFE PERSONNEL

Table 1. Percentage response to professional wildlife personnel survey questions.

QUESTION	RESPONSE					
	NONE	1–2	3–5	6–10	Over 10	No Response
No. red foxes seen per year within last 2–3 years	71.6	19.7	5.5	2.2	0.5	0.5
No. red fox tracks seen per year within last 2–3 years	74.9	12.6	4.4	3.8	1.6	2.7
No. red fox reports received per year within last 2–3 years	53.6	27.3	11.5	3.3	1.1	3.3
No. gray foxes seen per year within last 2–3 years	27.9	24.6	23.5	11.5	12.0	0.5
No. gray fox tracks seen per year within last 2–3 years	35.5	9.3	15.3	13.7	21.9	4.4
No. bobcats seen per year within last 2–3 years	9.8	13.1	29.5	16.9	30.1	0.5
No. bobcat tracks seen per year within last 2–3 years	10.9	7.1	12.0	13.7	55.7	0.5

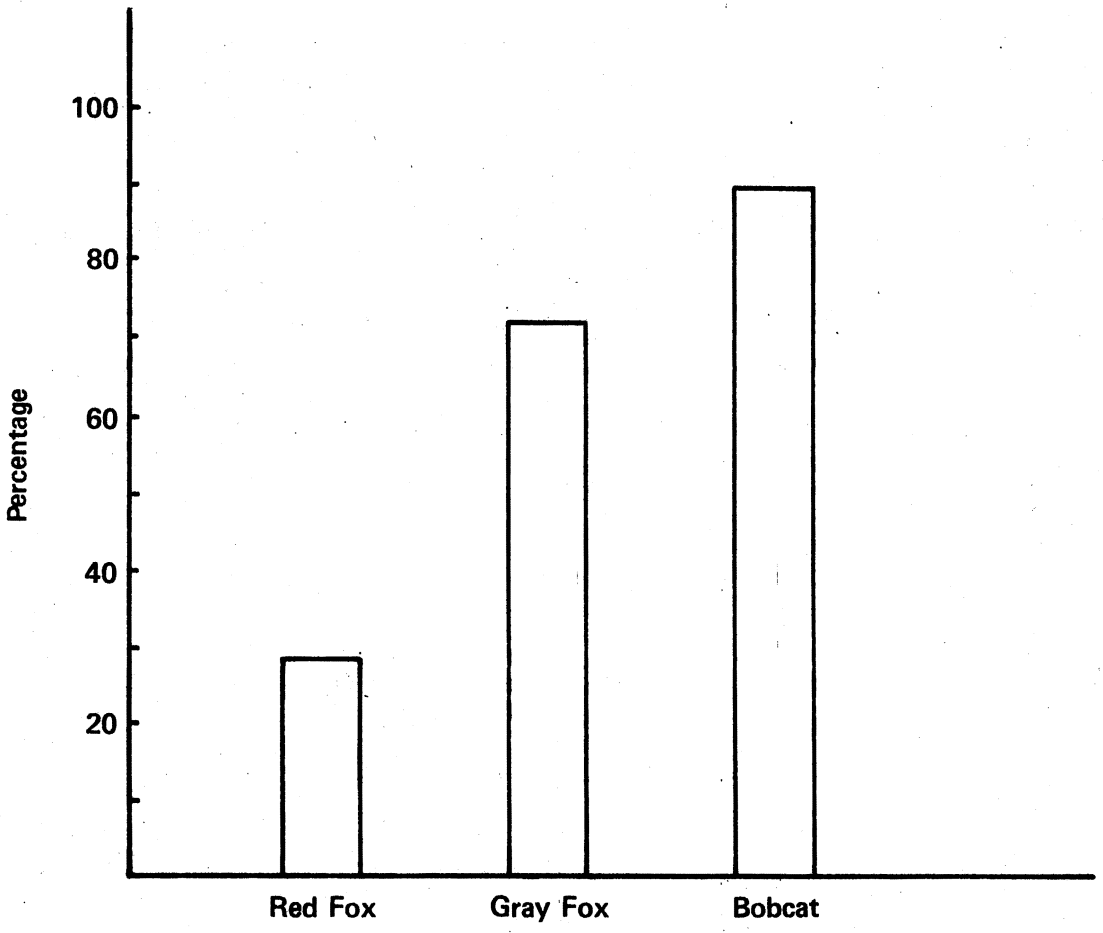

Fig. 1. Percentage respondents reporting 1 or more sightings per year over the past 2-3 years.

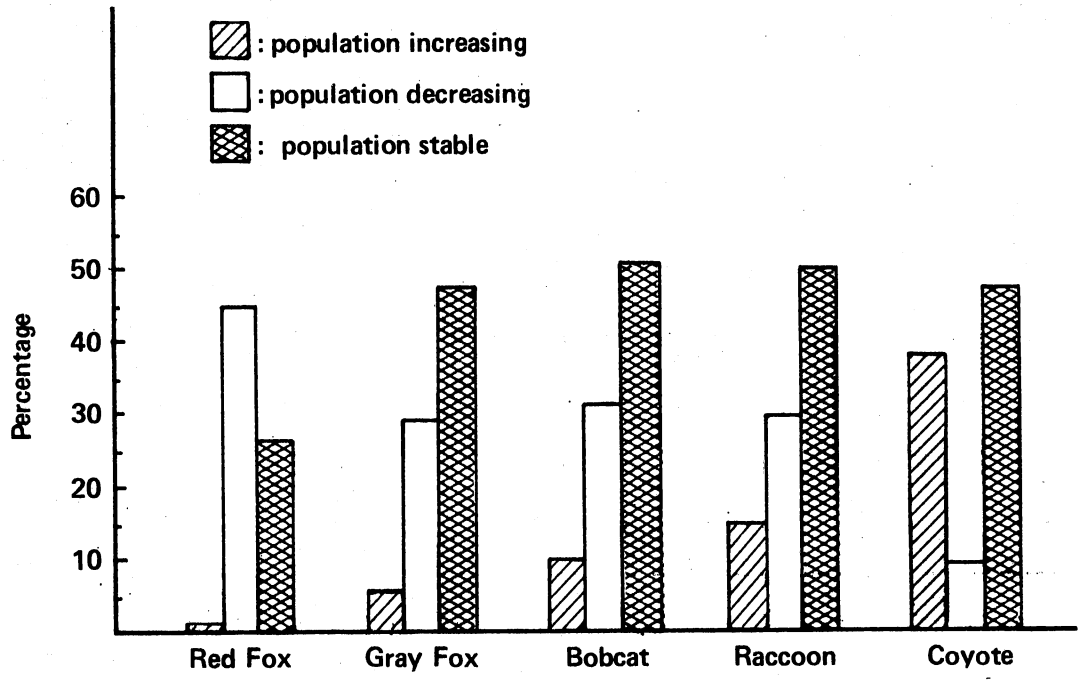

Fig. 2. Response distribution to survey question regarding status of 5 furbearer populations.

APPENDIX D

RED FOX DISTRIBUTION BY COUNTY FROM QUESTIONNAIRE RESULTS

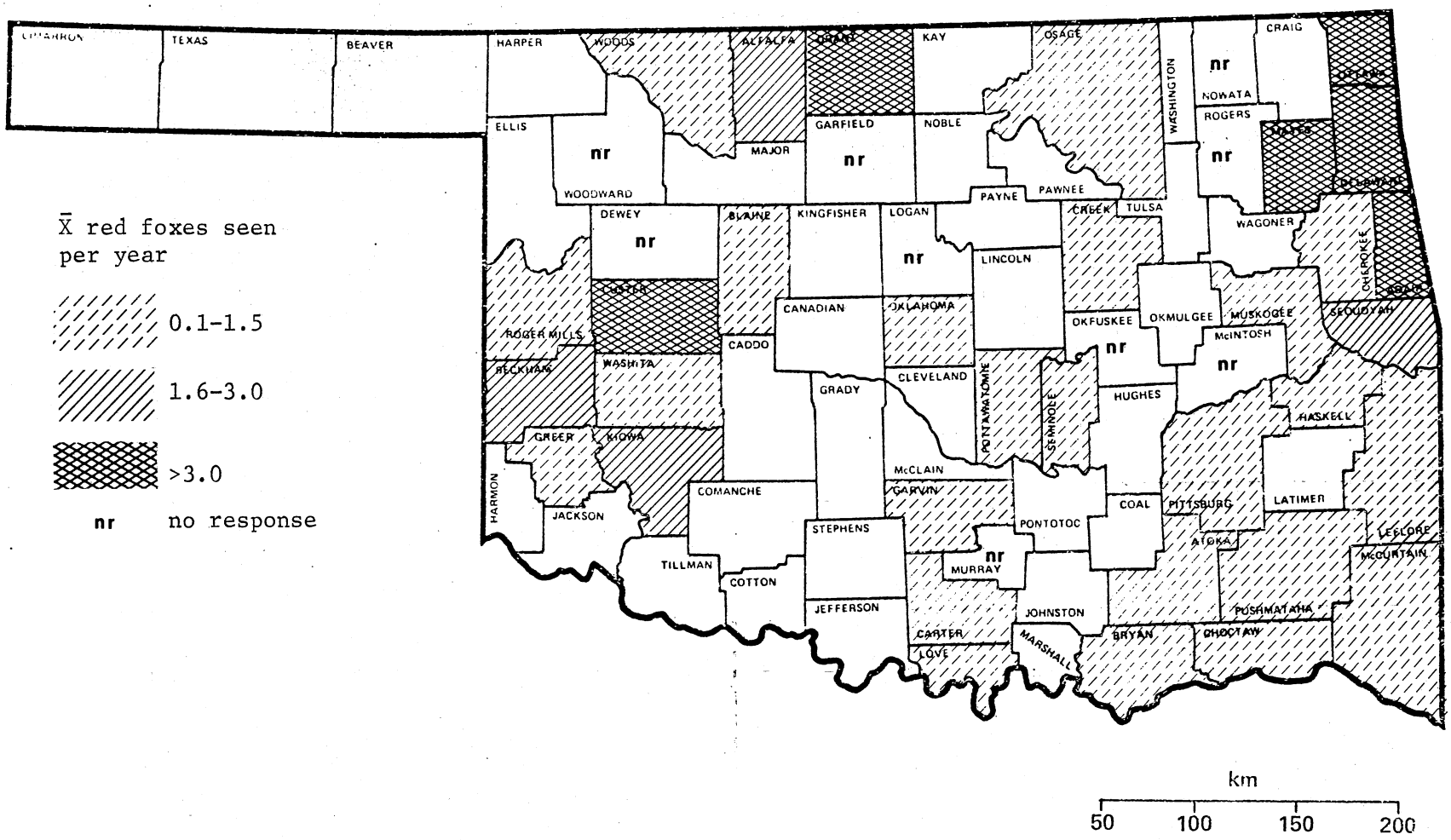

Fig. 3. Red fox distribution by county from questionnaire results.

APPENDIX E

GRAY FOX DISTRIBUTION BY COUNTY FROM QUESTIONNAIRE RESULTS

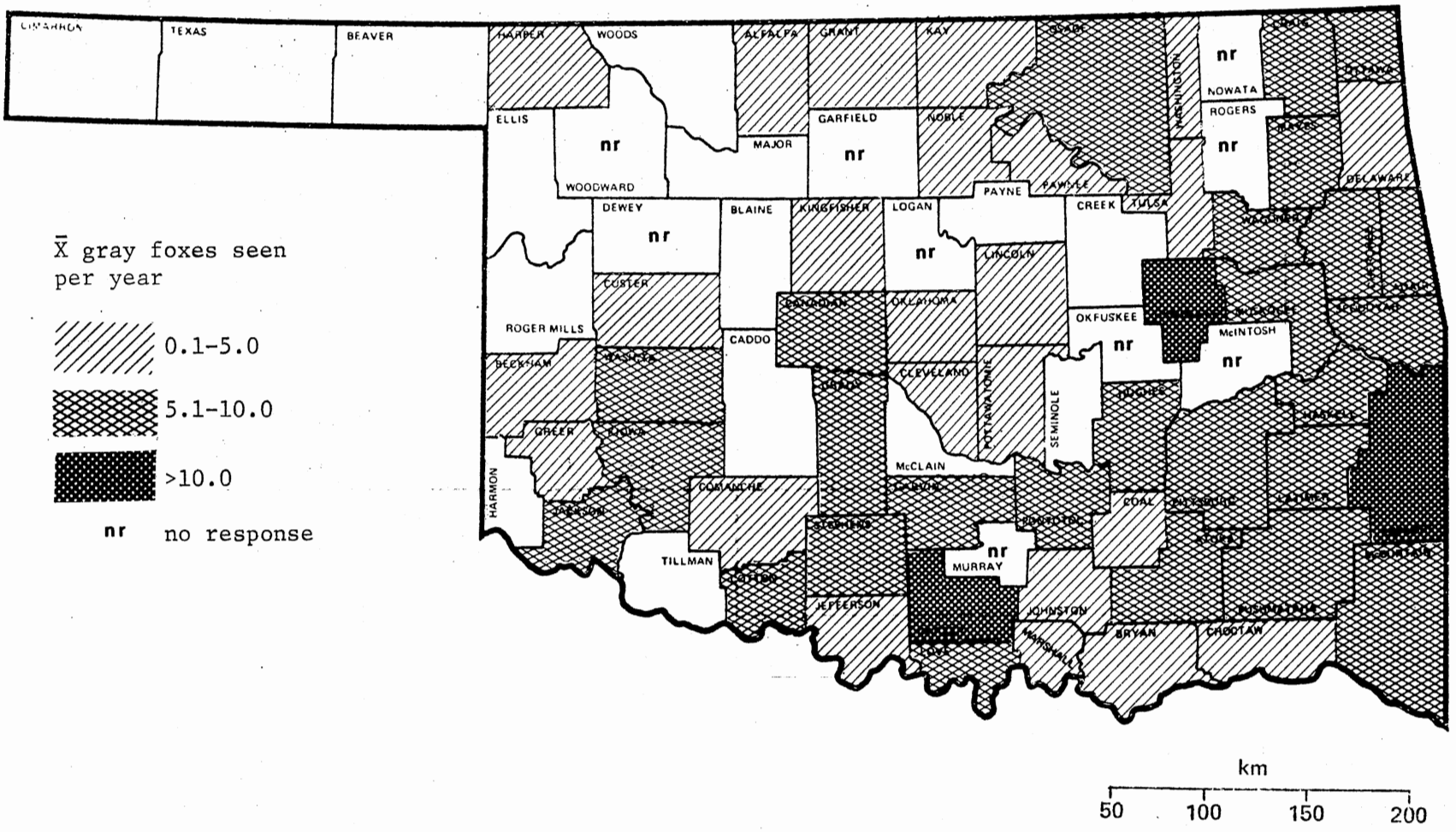

Fig. 4. Gray fox distribution by county from questionnaire results.

APPENDIX F

BOBCAT DISTRIBUTION BY COUNTY FROM QUESTIONNAIRE RESULTS

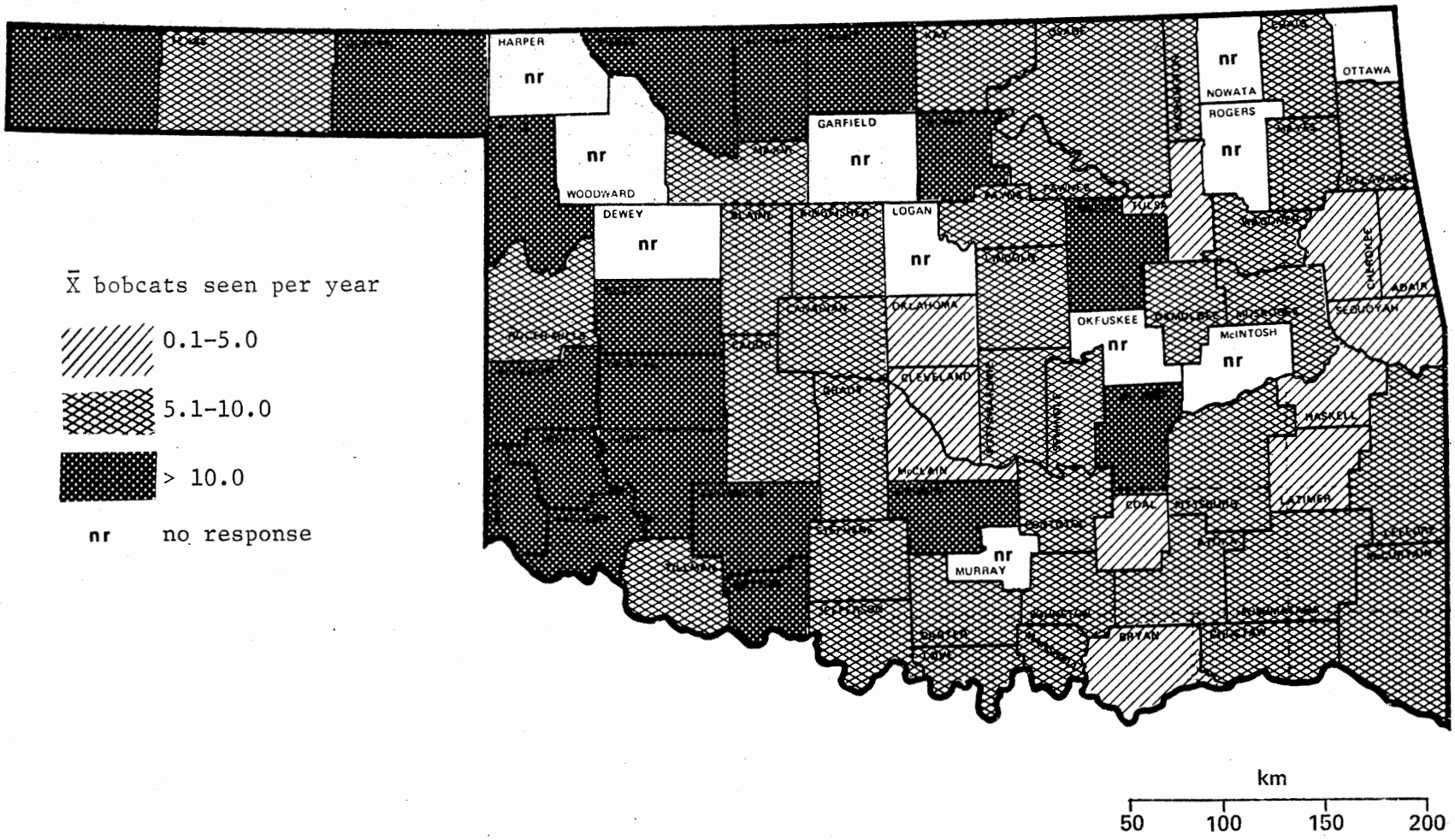

Fig. 5. Bobcat distribution by county from questionnaire results.

APPENDIX G

COVER LETTERS, QUESTIONNAIRE AND RESULTS OF PRELIMINARY FARM OPERATOR SURVEY CONDUCTED IN DELAWARE COUNTY

OKLAHOMA COOPERATIVE WILDLIFE RESEARCH UNIT

OKLAHOMA STATE UNIVERSITY
404 LIFE SCIENCES WEST
STILLWATER, OKLAHOMA 74074
(405) 624-6340

COOPERATING AGENCIES:
OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION
OKLAHOMA STATE UNIVERSITY
WILDLIFE MANAGEMENT INSTITUTE
FISH AND WILDLIFE SERVICE
U. S. DEPARTMENT OF THE INTERIOR

Dear farm operator,

We need your help! The Oklahoma Cooperative Wildlife Research Unit at O.S.U. is conducting a survey for the Oklahoma Department of Wildlife Conservation to help determine the range of foxes in Oklahoma. As a part of this project, we would like to know if you are aware of any red or gray fox dens on any of the land you own or operate in Delaware County. The foxes will not be disturbed.

Please take a minute to complete this short questionnaire and drop it in the mail. Postage has been paid.

When answering the questions remember that a red fox has a reddish color over nearly all of its body, has black legs and ears, and has a white tip on its bushy tail. A gray fox is mostly gray and black, but has some red along its sides, chest and legs.

If you have a fox denning on the land you operate, and you are not sure which kind of fox it is, or if you have not seen a fox den on the land you operate, your answer is still important.

Please call the Oklahoma Cooperative Wildlife Research Unit at the number given below if you have any questions or comments regarding this survey. If you would like to receive a summary of the findings of this project, just check the box at the bottom of the card.

Thanks for your help!

Sincerely,

Richard T. Hatcher

Richard T. Hatcher
Research Assistant
Ok. Coop. Wildl. Res. Unit
405/ 624-6340

OKLAHOMA COOPERATIVE WILDLIFE RESEARCH UNIT

OKLAHOMA STATE UNIVERSITY
404 LIFE SCIENCES WEST
STILLWATER, OKLAHOMA 74074
(405) 624-6340

COOPERATING AGENCIES:
OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION
OKLAHOMA STATE UNIVERSITY
WILDLIFE MANAGEMENT INSTITUTE
FISH AND WILDLIFE SERVICE
U. S. DEPARTMENT OF THE INTERIOR

April 11, 1978

Dear farm operator,

The Oklahoma Cooperative Wildlife Research Unit at O.S.U. is conducting a survey for the Oklahoma Department of Wildlife Conservation to help determine the range of foxes in Oklahoma. Recently I mailed you a brief questionnaire regarding red and gray fox dens on the land you operate. Since I have not received this information, I have enclosed another questionnaire. Please complete the questionnaire and return it at your earliest convenience, even if you are not aware of any fox dens.

When answering the questions remember that a red fox has a reddish color over nearly all of its body, has black legs and ears, and has a white tip on its bushy tail. A gray fox is mostly gray and black, but has some red along its sides, chest and legs.

Please call the Oklahoma Cooperative Wildlife Research Unit at the number given below if you have any questions or comments regarding this survey. If you would like to receive a summary of the findings of this project, just check the box at the bottom of the card.

It will take just a minute to complete and return this questionnaire. Postage has been paid. Your response is needed as soon as possible. Thank you.

Sincerely,

Richard T. Hatcher
Research Assistant
Okla. Coop. Wildl. Res. Unit
405/ 624-6340

FOX SURVEY

1. How many acres do you manage (that is, own or operate) in Delaware County?_____

2. On the area you manage, are you aware of any dens being used this year by RED FOXES? YES _____ NO _____
   If so, how many dens?

3. On the area you manage, are you aware of any dens being used this year by GRAY FOXES? YES _____ NO _____
   If so, how many dens?

4. On the area you manage, are you aware of any dens used this year by FOXES, but you are not certain which kind of fox? YES _____ NO _____
   If so, how many dens?

If you would like to receive a summary of the findings of this project just check here _____.

Thank you for your help! Please drop this card in the mail as soon as possible.

Table 2. Summary statistics of preliminary farm operator survey, Delaware County, 1978.

Number of questionnaires mailed	100
Number of questionnaires received	60
Number of red fox dens reported	1
Number of gray fox dens reported	0
Number of unknown fox dens reported	0
Land area sampled (A)	21677
Percent area sampled in county	4.3

APPENDIX H

COVER LETTERS SENT WITH FARM OPERATOR SURVEY

OKLAHOMA COOPERATIVE WILDLIFE RESEARCH UNIT

OKLAHOMA STATE UNIVERSITY
404 LIFE SCIENCES WEST
STILLWATER, OKLAHOMA 74074
(405) 624-6340

COOPERATING AGENCIES:
OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION
OKLAHOMA STATE UNIVERSITY
WILDLIFE MANAGEMENT INSTITUTE
FISH AND WILDLIFE SERVICE
U. S. DEPARTMENT OF THE INTERIOR

June 12, 1978

Dear farm operator,

We need your help! The Oklahoma Cooperative Wildlife Research Unit at O.S.U. is conducting a survey for the Oklahoma Department of Wildlife Conservation to help determine the status of coyotes, bobcats and foxes in Oklahoma. As a part of this project, I would like to know if you have seen any coyotes, bobcats, red foxes or gray foxes this year on any of the land you own or operate in Delaware County.

Please take a minute to complete this short questionnaire and drop it in the mail. Postage has been paid.

When answering the questions, remember that a coyote looks like a gray or brown medium-sized dog. A bobcat is larger than a housecat, is brown with black spots, and has a short tail. A red fox has a red to reddish yellow color over most of its body, has black legs and ears, and has a white tip on its bushy tail. A gray fox is mostly gray and black, but has some red along its sides, chest and legs. Foxes are smaller than coyotes. Your answer concerning foxes is still needed even if you are not certain which kind of fox you have seen.

If you have any questions or comments regarding this survey, call the Oklahoma Cooperative Wildlife Research Unit at the number given above. If you would like to receive a summary of the findings of this project, just check the box at the bottom of the card.

Thanks for your help.

Sincerely,

Richard T. Hatcher

Richard T. Hatcher
Research Assistant

OKLAHOMA COOPERATIVE WILDLIFE RESEARCH UNIT

OKLAHOMA STATE UNIVERSITY
404 LIFE SCIENCES WEST
STILLWATER, OKLAHOMA 74074
(405) 624-6340

COOPERATING AGENCIES:
OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION
OKLAHOMA STATE UNIVERSITY
WILDLIFE MANAGEMENT INSTITUTE
FISH AND WILDLIFE SERVICE
U. S. DEPARTMENT OF THE INTERIOR

July 17, 1978

Dear farm operator,

The Oklahoma Cooperative Wildlife Research Unit at O.S.U. is conducting a survey for the Oklahoma Department of Wildlife Conservation to help determine the status of coyotes, bobcats and foxes in Oklahoma. Recently I mailed you a brief questionnaire regarding any coyotes, bobcats or foxes seen this year on any of the land you own or operate in Atoka County. Since I have not received this information from you, I have enclosed another copy of the questionnaire.

It will take just a minute to complete and return this questionnaire. Postage has been paid. Your response is needed as soon as possible.

Please call the Oklahoma Cooperative Wildlife Research Unit at the number given above if you have any questions or comments regarding this survey. If you would like to receive a summary of the results of this project, just check the box at the bottom of the card.

Thank you for your help.

Sincerely,

Richard T. Hatcher
Research Assistant

APPENDIX I

LOCATION OF 5 COUNTIES IN WHICH FURBEARER SURVEYS WERE CONDUCTED

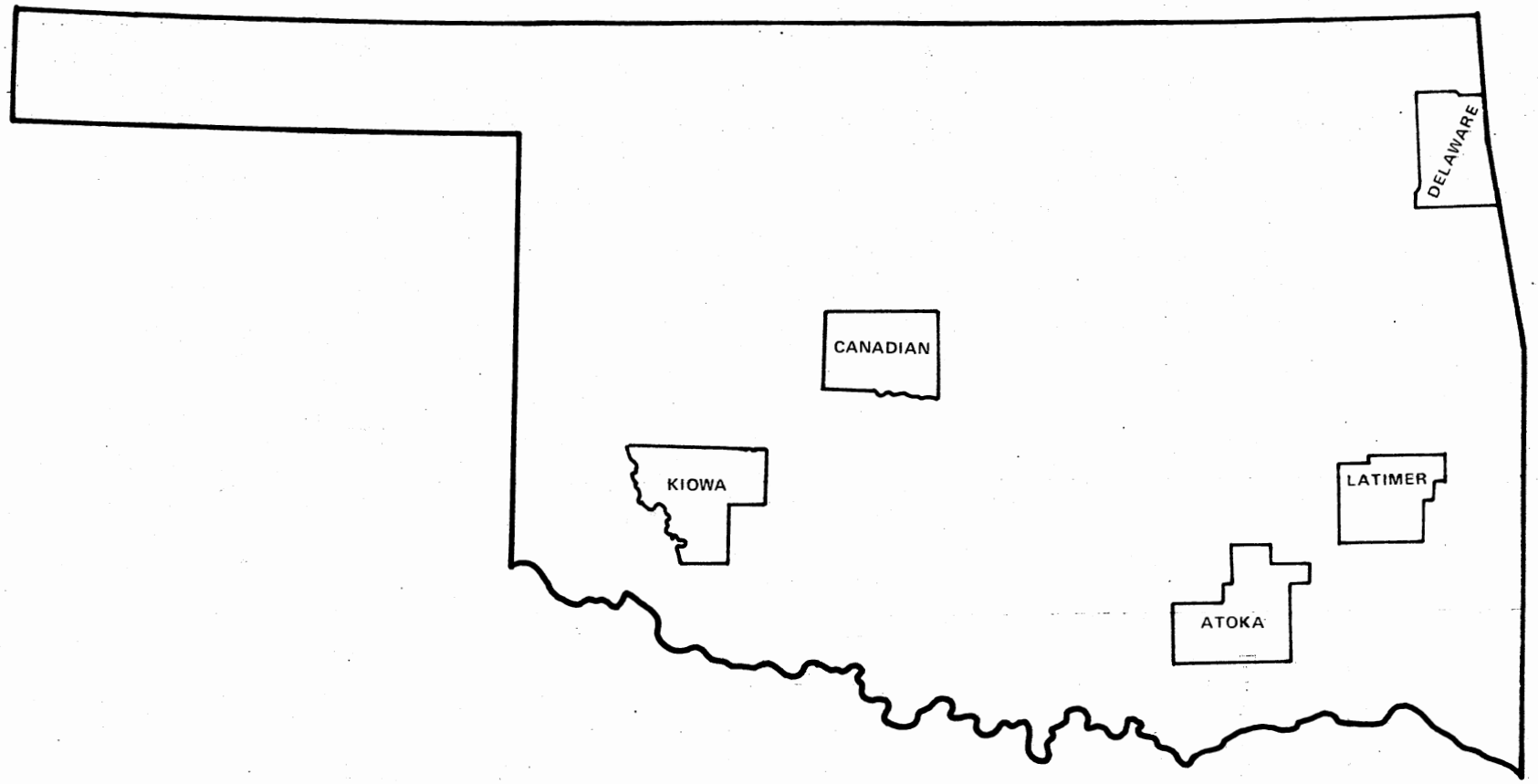

Fig. 6. Location of 5 counties in which furbearer surveys were conducted.

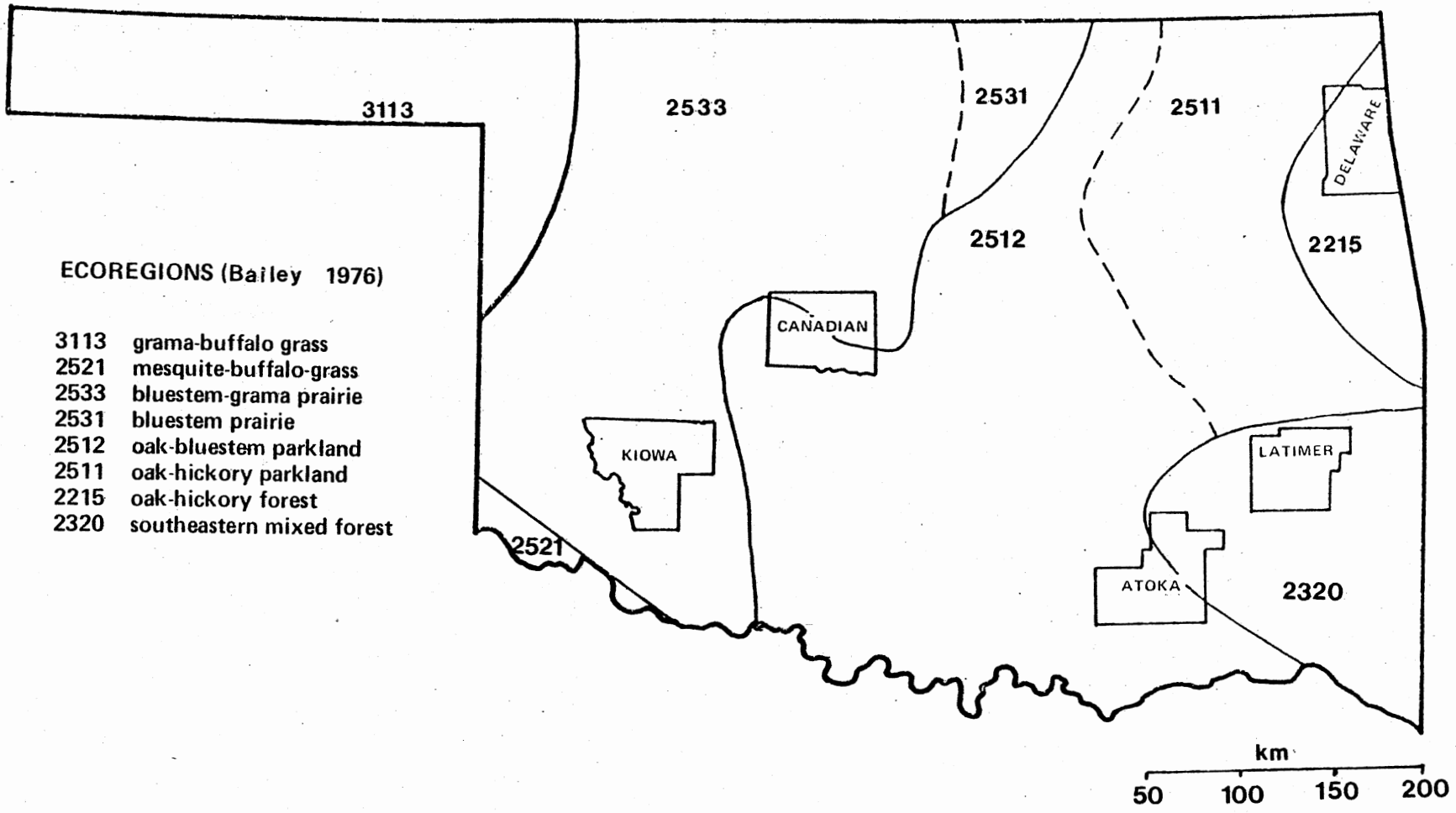

Fig. 7. Location of 5 counties, relative to ecoregions, in which furbearer surveys were conducted.

APPENDIX J

LOCATIONS OF SCENT STATION SURVEY ROUTES IN THE 5 COUNTIES COMPARED

ATOKA COUNTY

Nonrandom Routes (NSSS) Conducted

15-16 August 1978

Line 1 T4S R13E Sec 2 -- T4S R12E Sec 3

Random Routes (RSSS) COnducted 26-27 July,

15-16 August 1978

Line 1 T2S R10E Sec 22 -- T3S R10E Sec 3

Line 2 T3S R11E Sec 14 -- T2S R11E Sec 35

Line 3 T4S R13E Sec 31 -- T4S R13E Sec 34

Line 4 T2S R12E Sec 26 -- T2S R13E Sec 19

Line 5 T1N R14E Sec 25 -- T1N R14E Sec 11

CANADIAN COUNTY

Nonrandom Routes (NSSS) Conducted

29-30 August 1978

Line 1 T12N R9W Sec 31 -- T12N R10W Sec 22

Line 2 T12N R10W Sec 3 -- T14N R10W Sec 25

Random Routes (RSSS) Conducted 21-22 July,

11-12 August 1978

Line 1 T13N R5W Sec 29 -- T13N R5W Sec 8

Line 2 T12N R6W Sec 11 -- T11N R6W Sec 18

Line 3 T11N R8W Sec 12 -- T11N R8W Sec 15

Line 4 T12N R9W Sec 27 -- T12N R10W Sec 25

Line 5 T13N R9W Sec 15 -- T13N R9W Sec 18

DELAWARE COUNTY

Nonrandom Routes (NSSS) Conducted

21-22 August 1978

Line 1 T20N R25E Sec 13 -- T20N R25E Sec 14

Line 2 T22N R24E Sec 26 -- T22N R24E Sec 9

Line 3 T23N R24E Sec 23 -- T23N R25E Sec 5

Random Routes (RSSS) Conducted 1-2 August,

21-22 August 1978

Line 1 T22N R22E Sec 28 -- T22N R22E Sec 31

Line 2 T20N R24E Sec 8 -- T20N R24E Sec 11

Line 3 T21N R25E Sec 17 -- T21N R25E Sec 14

Line 4 T22N R24E Sec 29 -- T22N R24E Sec 9

Line 5 T24N R25E Sec 31 -- T24N R25E Sec 34

KIOWA COUNTY

Nonrandom Route (NSSS) Conducted

8-9 August 1978

T5N R19W Sec 30 -- T4N R18W Sec 2

Random Routes (RSSS) Conducted 18-19 July,

21-22 August 1978

Line 1 T2N R16W Sec 35 -- T2N R16W Sec 33

Line 2 T4N R16W Sec 17 -- T4N R16W Sec 14

Line 3 T5N R18W Sec 36 -- T5N R18W Sec 13

Line 4 T5N R19W Sec 3 -- T6N R19W Sec 22

Line 5 T7N R16W Sec 25 -- T6N R16W Sec 12

LATIMER COUNTY

Nonrandom Route (NSSS) Conducted

13-14 August 1978

T6N R19E Sec 3 -- T6N R21E Sec 17

Random Routes (RSSS) Conducted 29-30 July,

18-19 August 1978

Line 1 T5N R19E Sec 22 -- T5N R20E Sec 10

Line 2 T3N R19E Sec 32 -- T3N R18E Sec 35

Line 3 T3N R20E Sec 20 -- T3N R20E Sec 23

Line 4 T5N R20E Sec 36 -- T5N R20E Sec 23

Line 5 T6N R21E Sec 12 -- T7N R22E Sec 5

APPENDIX K

NUMBER OF VISITS BY ALL SPECIES RECORDED ON SCENT STATION SURVEYS, IN 5 OKLAHOMA COUNTIES, 1978

Table 3. Number of visits by all species recorded on RSSS, July and August 1978

	Survey period	County				
		Atoka	Canadian	Delaware	Kiowa	Latimer
Scent station-nights	July	90	100	100	100	100
	Aug	100	100	100	95	100
Coyote	July	2	1	1	4	4
	Aug	1	1	1	8	6
Bobcat	July	0	1	1	2	0
	Aug	1	0	0	0	2
Red fox	July	0	1	0	0	0
	Aug	0	0	0	0	0
Gray fox	July	0	0	1	0	0
	Aug	0	0	0	0	0
Raccoon	July	1	2	1	3	0
	Aug	1	1	3	2	0
Opossum	July	0	1	2	2	1
	Aug	6	5	1	1	0
Skunk	July	1	0	1	2	2
	Aug	1	4	0	4	0
Badger	July	0	0	0	2	0
	Aug	0	0	0	0	0
Domestic dog	July	10	4	12	0	15
	Aug	3	7	15	1	9
Housecat	July	11	4	14	4	3
	Aug	9		8	11	4

Table 4. Number of visits by all species recorded on NSSS for 5 survey counties, August 1978.*

	County				
	Atoka	Canadian	Delaware	Kiowa	Latimer
Scent station-nights	100	97	100	100	99
Coyote	9	13	10	28	2
Bobcat	2	5	11	4	2
Fox	2	2	19	2	2
Raccoon	3	8	25	10	24
Opossum	5	3	5	0	0
Skunk	0	10	2	0	0
Badger	0	1	0	0	0
Domestic dog	5	4	6	1	5
Housecat	3	4	0	0	0

*Data obtained from Oklahoma Department of Wildlife Conservation.

APPENDIX L

ALTERNATIVE REPRESENTATIONS OF SURVEY DATA

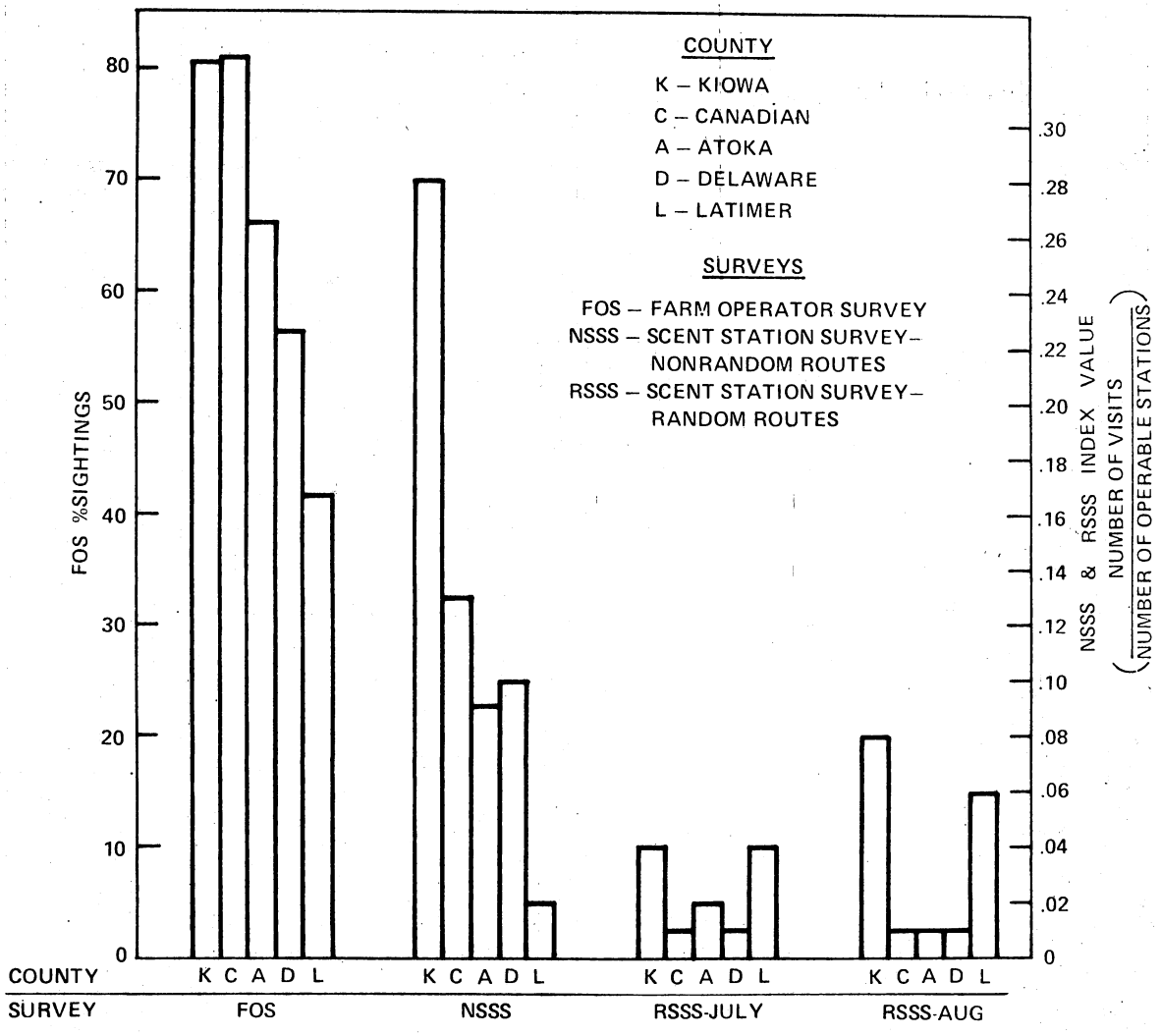

Fig. 8. Indices of coyote populations from 3 survey methods in 5 Oklahoma counties.

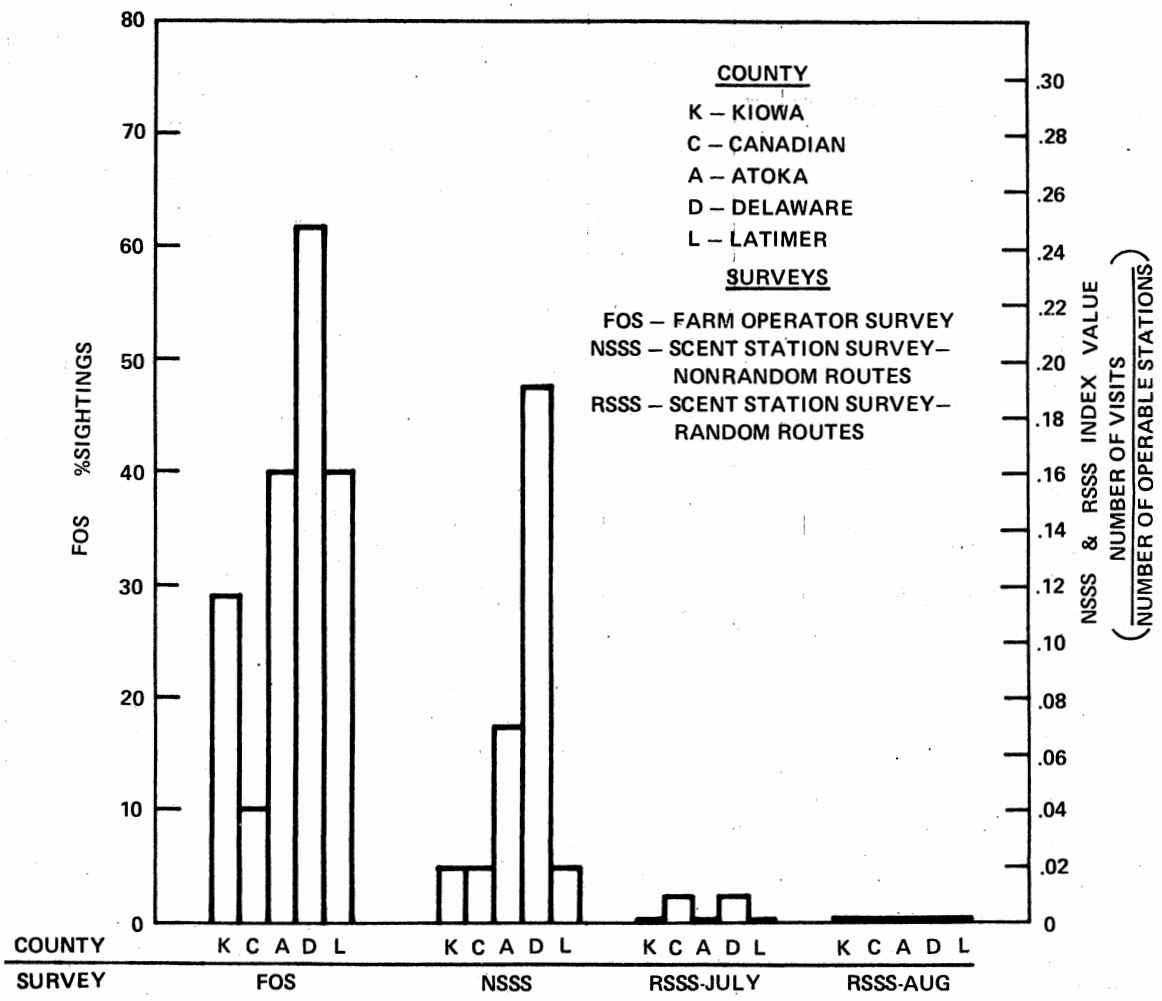

Fig. 9. Indices of fox populations from 3 survey methods in 5 Oklahoma counties.

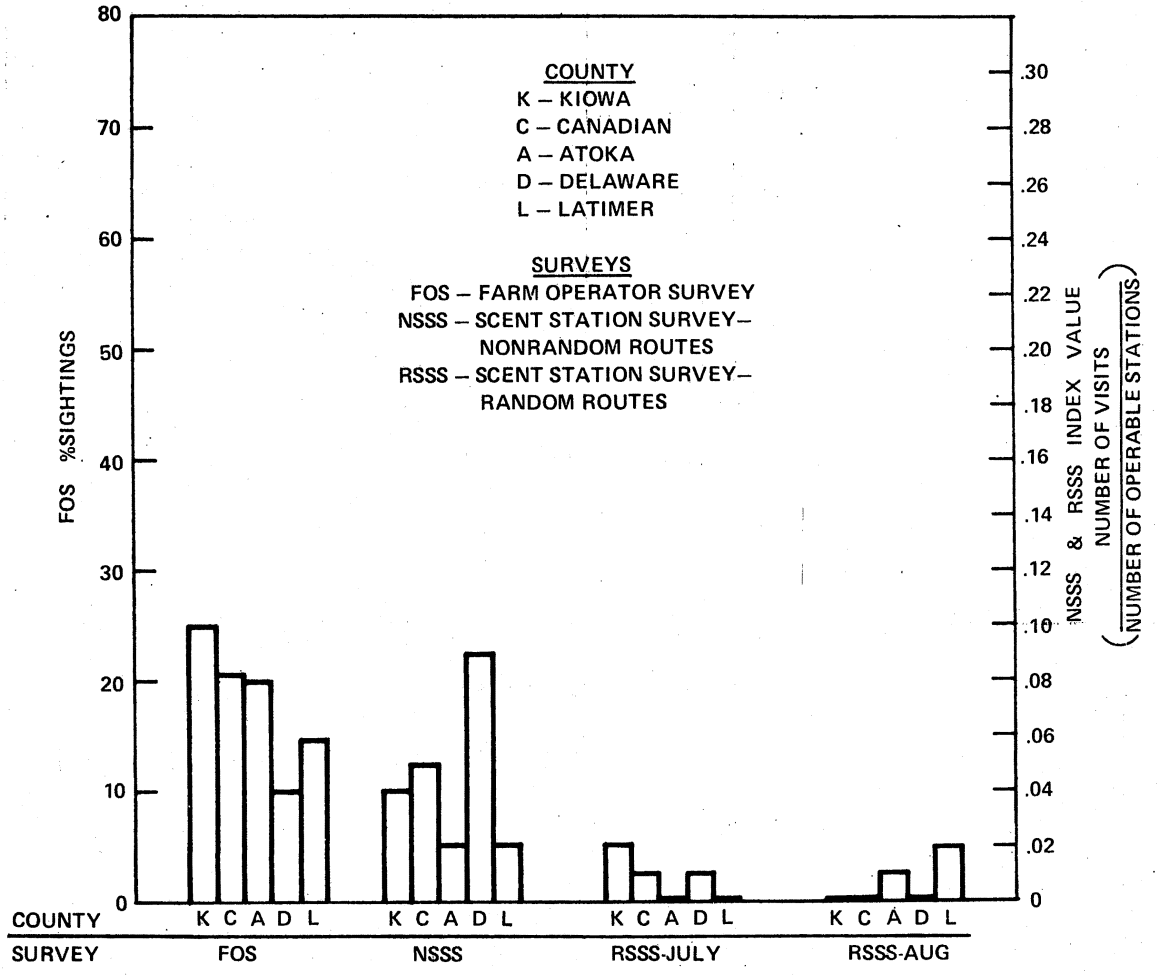

Fig. 10. Indices of bobcat populations from 3 survey methods in 5 Oklahoma counties.

VITA[2]

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Master of Science

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